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The Analysis of Palaeobotanical Remains from Native American Sites in the Tennessee Region of the Upper Cumberland Plateau.

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The Analysis of Palaeobotanical Remains from Native American Sites in the Tennessee Region

of the Upper Cumberland Plateau

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by

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ABSTRACT

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Sediment samples were collected from 3 rock shelter sites and one natural pond on the Upper Cumberland Plateau. Samples were processed to quantitatively and qualitatively evaluate pollen and charcoal abundance as well as other palaeobotanicals. The analysis was to determine when prehistoric Native Americans began controlled burns to enhance resources acquisition. Samples were also analyzed for the presence of pollen to determine vegetation changes that may accompany the use of controlled burns and to determine the onset of horticulture. The Upper Cumberland Plateau is often considered a marginal area used only seasonally by Native Americans; however, management practices may have been highly refined to maximize resources acquisition. Results show evidence of overt land management and usage of the area by Native Americans over several thousand years. Remains indicate reliance upon nut producing trees. This reliance led to land management practices designed to maximize availability of said resources.

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CHAPTER 1
INTRODUCTION

The Cumberland Plateau is a unique geographic formation stretching from Kentucky through Tennessee and into Alabama and Georgia. Various studies have explored the paleoecological, ethnobotanical record, and vegetational history of the region (Delcourt 1979; Delcourt and Delcourt 1980, 1981,1987, 1997; Delcourt et al. 1998). These studies are generally limited to the Quaternary Period or even more specifically the Holocene Epoch of that period. The Delcourt and Delcourt study of 1987 involving the nature of forest dynamics centered around changes in landscape as well as climate (Delcourt and Delcourt 1987).

In most cases this research provides a broad view of the environmental history of specific areas within the Southeastern United States or the environmental history of the Southeastern United States as a whole. "Man-land Interaction: 10,000 Years of American Indian Impact on Native Ecosystems in the Lower Little Tennessee River Valley, Eastern Tennessee" is an accurate example of this. The study centered around natural and human caused changes to the region. It finally concluded that while there was evidence of Native Americans in the region as long ago as 12,000 years ago, actual evidence of Native American influence on vegetation was not apparent until 4,000 years ago (Chapman et al. 1982). In some instances the content of the studies focused on analyses of specific sites. Such is the case in articles like "Holocene Ethnobotanical and Paleoecological Record of Human Impact on Vegetation in the Little Tennessee River Valley, Tennessee" in which the evidence showed distinct changes in wood taxa burned by Native Americans over a period of several thousand years as well as the adoption of various crop plants into their diet (Delcourt et al. 1986).

Fossil pollen has become an essential part in reconstructing the local and regional palaeoenvironment at archaeological sites (Bryant and Hall 1993:277). This is accomplished by comparing palynomorphs from archaeological sites to those from modern pollen assemblages (Liu and Lam 1985:115). Generally the method involves comparison to modern composition analogues, although there are methods for reconstructing environments for which modern analogues do not exist (Fauquette et al. 1998). Concerning the reliability of pollen, Jackson has said (as quoted in Kidwell and Flessa 1994) that while complex, the relationship between fossil pollen and the source vegetation was comprehensible. The difficulty lies in physical and biological processes that separate the source vegetation from the pollen assemblages. Nonetheless, once understood the distortions and biases caused by such processes can be corrected for, providing valuable information.

At times environmental conditions such as high pH, microbial activity, and repeated cycles of soil hydration-dehydration can contribute to the destruction of pollen. This is a recurring problem in sites in Southeastern North America (Delcourt and Delcourt 1980:227, Bryant and Hall 1993:282). In such circumstances alternative sources for interpretation must be found.

Analysis of charcoal will provide the fire history of an area as well as providing supportive evidence on the impact of human presence to forest composition. Prehistoric humans have been linked to evidence of frequent fires in the Cumberland Plateau fossil assemblage (Delcourt et al. 1998). It has also been shown that these fires are responsible for the development and current ecological condition of oak forests (Abrams 1992).

Study of the Upper Cumberland Plateau (UCP) area has uncovered thousands of rockshelter sites of archaeological importance throughout Kentucky and Tennessee. These sites contain artifacts including those of Paleo-Indian, Archaic, Woodland , and Mississippian origin (Des Jean and Benthall 1994:117,120,132, 135). Two Tennessee sites, Eagle Drink Bluff Shelter and Far View Gap Bluff Shelter, have yielded evidence of frequent habitation as far back as 6,000 yrs. B.P. A great deal of archaeologically significant data has been found at these locations as well as others on the plateau (Franklin 2008). The purpose herein is to provide an analysis of multiple sites in the UCP based on palaeobotanical evidence. Most importantly, the analysis intends to provide an outline of the vegetational, climatic, and fire history as well as provide detail on Native American land management practices in the region.

A study of Anderson Pond provides the climatic/vegetational history of the Eastern Highland Rim of the UCP. Based on H. Delcourt’s 1979 paper, the Southeastern region of the United States experienced drastic and significant changes in vegetation related to temperature as well as water availability (Delcourt 1979:277-273). Anderson Pond is located just off of the Cumberland Plateau in White County, TN (36°02’N, 85°30’W). It is an ideal research site for this study because it contains a continuous record of events in the southeastern United States (Delcourt 1979:256-257). The chronology from the Anderson Pond study covers approximately 25,000 years (Delcourt 1979:262). It is approximately 60 km from the sites that are the focus for this study.

Again, following the work of Delcourt's 1980 study, approximately 25,000 ±3000 yrs. BP, the vegetation of this region was diverse and included multiple trees such as jack pine, spruce, fir, oak, ash, ironwood, hickory, etc. The presence of jack pine pollen in the assemblage indicates a cold climate, although pollen from other plants (oak, ash, hickory, etc.) indicates climatic conditions not severe enough to prevent their growth. Conditions here are similar to those found in modern Minnesota. From 19,000-16,300 yrs. BP, the pollen assemblage indicates a cooling trend with pine becoming quite abundant . The increase of these trees indicates that the shift in climate allowed them to out-compete the deciduous plants in the area. This assemblage occurs during the Late Wisconsin continental glaciation. Winters were long and summers were short.   For a modern analogue one would turn to modern southern Manitoba. Around 16,300 to 12,500 yrs. BP, samples show an increase in deciduous plants (oak, ash, ironwood, and hickory) as well as a decrease in jack pine. This shift in dominant flora indicates a lengthening growth period and an increase in abundance of plant-types that generally signify warmer climate. Soon after that the abundance of oaks, ash, birch, elm, and beech among others signifies the first appearance of the mixed-mesophytic forest. This type of forest cover lasted from around 12,500-10,000 yrs. BP. The climate conditions were likely cool with a moderate amount of rainfall. This pollen spectra is similar to what is seen in modern northeastern Minnesota and northeastern Wisconsin. There is a warming period from 8,000-5, 000 yrs. BP (the Hypsithermal). Common plants during this time include oak, ash, hickory, birch, alder, buttonbush, and Virginia willow.   At about 5,000 yrs. BP, composition resembles that of today's Ozark Mountains. From 5,000 yrs. BP to the present there is very little recorded change. Pines continue to reduce in presence. By ≈2,000 yrs. BP the pollen spectrum indicates conditions nearly identical to those present immediately prior to European colonization (Delcourt 1979).

Delcourt et al. (1998) provides a similar study for a site in Kentucky (Cliff Palace Pond). Cliff Palace Pond is located in Jackson County in southeastern Kentucky (37°31'34"N, 83°55’44”W). It is on the eastern edge of the northern Cumberland Plateau. The information on this site is included here due to its role as a local, long-term Native American habitation. Additionally, it was deemed that it would provide an accurate fossil pollen sequence as well as charcoal data. Cliff Palace Pond is approximately 150 km from the sites in this current study This sequence commences at the early Holocene (Delcourt et al. 1998:263-264,266).

Beginning in 9,500-7,300 BP Cliff Palace Pond was still dominated by boreal forest taxa, namely spruce and cedar. Disturbance likely in the form of disasters such as fires, landslides, and strong winds was common. Due to these frequent disturbances, such taxa as hornbeam, birch, alder, and aspen were highly favored. From 7,300-4800 yrs. BP cedar was replaced by oak, hickory, hemlock, basswood, sugar maple, and butternut, members common to the mixed-mesophytic forest community. During this time the climate was humid and warm-temperate. Additionally, temperature changes between seasons were less severe than now. At the time of the Hypsithermal, storms were common. This served to increase precipitation while reducing the occurrence of fires. At around 4,800 BP hemlock was no longer present in the pollen spectra. This is likely due to the die-off of mature species caused by the hemlock looper. Such a large-scale die-off would leave abundant wood fuel, causing any fire events to be particularly destructive. An increase in charcoal levels as well as an increase in oak, chestnut, and pine (fire-tolerant species) at 3,000 yrs. BP indicates that fires did in fact occur. From 3,000 to 200 yrs. BP it is clear that frequent, land-managed fires were occurring with consistency. The presence of trees such as dogwood, oak, chestnut, hickory, walnut, tulip poplar, white pine, and sweetgum indicate increased diversification of the mixed-mesophytic forest. Eventually plant pollen from members of the Eastern Agricultural Complex became present in the samples. While this could indicate the occurrence of agriculture within the region of Cliff Palace Pond, it is also entirely possible that these were naturally occurring wild plants. However, the increase in *Ambrosia* type pollen (ragweed) would indicate significant disturbance possibly associated with the kind of land-clearing that would be expected from agricultural practices (Delcourt et al. 1998). Additionally, this evidence coupled with the ethnobotanical samples from nearby Cloudsplitter Rockshelter and Cold Oak Shelter seems to remove any doubt that agriculture/horticulture was occurring in the immediate area (Delcourt et al. 1998:266).

These Delcourt studies provide insight into the climatic history of a lesser known area of the southeastern United States.   Having adequately discussed the climatic and vegetational history of the UCP, it now becomes necessary to detail the cultural history of the region. Archaeology in the southeast has long been narrowly focused on lowland regions. The reason for this is likely the misconception that highland regions, and by extension Southern Appalachia, are marginal zones and culturally undeveloped (Franklin and Bow 2009:145). A study published in 2005 on upland regions in and around the Alps addressed the idea of marginality in association with sites. It included multiple sites that ranged in age from over 12,000 BP to modern some at elevations in excess of 2000m. The study established that multiple upland habitations were unaffected by periods of climatic deterioration. In fact it seemed more likely that the determining factor of whether upland sites were used were social or cultural in nature (Walsh 2005). Perhaps most surprising is that the elevations dealt with in the study on the Alps far surpass those commonly associated with sites associated with prehistoric habitation in the Appalachian region.

Perhaps the best argument against the marginality of the Appalachian Highland cultures resides within the development of the Eastern Agricultural Complex. Currently, despite the riverine floodplain origins of such plants as squash (*Cucurbita pepo*), sumpweed (*Iva annua*), goosefoot (*Chenopodium* spp.), and maygrass (*Phalaris caroliniana*), the earliest evidence of their cultivation come from upland settings. While new discoveries from the lowland regions, predating these current ethnobotanical remains, could render this point moot, what is irrefutable is that the Appalachians present an impressively robust record of human/plant interactions among the native inhabitants of the region (Watson 2001:321).

Of particular importance is the transition from the Late Archaic to the Early Woodland. The Late Archaic to Early Woodland transition comes at the end of the Hypsithermal (Delcourt 1980:277). This is generally considered to have occurred anywhere from 4,000 to 2,700 yrs. BP (Delcourt et al. 1998:266). It is possible though, with the geographic uniqueness of the UCP in relation to the Middle Tennessee region, that the transition, as it occurred in the 2 areas, was not equal in time of occurrence nor duration. Because it has already been shown that the climate of the 2 regions could have been quite distinct, it is plausible that there were great disparities between life on the plateau and life in the lowland regions (Delcourt 1980:268-271,273-277; Delcourt et al. 1998:274-276).

For this time of transition (Late Archaic to Early Woodland) there are several indicators of increased sedentism: use of alternate local foods in times of shortage (mussels), emphasis on food storage, increased alliances with regular exchange of goods. All of these are seen in the Middle Tennessee Lowland region (Bentz 1988:277; Crites 1988:279). Similarly, in the UCP there is abundant evidence of mussels as well as trade contacts as evidenced by non-regional chert (Des Jean and Benthall 1994:127). The transition period from Late Archaic to the Early Woodland sees the development of horticultural/agricultural practices. Native Americans were known to use burning as a tool to facilitate the harvesting of wildlife. It is also likely that they were additionally aware of its capacity to improve crop productivity. Hammet supports this statement not only with ecological evidence of the plant's responses to controlled burns but also with the testimonies of individuals who have practiced or continue to practice similar techniques (Hammet 1997:200). The products of this development would have been members of the "Eastern Agricultural Complex". This complex includes such plants as sunflower (*Helianthus annus*), sumpweed (*Iva annua*), goosefoot (*Chenopodium* spp.), maygrass (*Phalaris caroliniana*), knotweed (*Polygonum erectum*), little barley (*Hordeum pusillum*), and local gourds (*Cucurbita pepo*) (Cowan 1997:63; Delcourt et al. 1998). Analysis of human palaeofeces from Big Bone Cave in the UCP of southern central Tennessee showed that by approximately 2,220 yrs. BP the use of domesticated seed crops made up roughly half the diet (Faulkner 1991:687, 696). Gourd seeds would have been especially important on the Cumberland Plateau when nut mast harvests were not sufficient enough for continued survival (Cowan 1997:72). This increasing reliance on cultivated plants grown in an agricultural manner would result in land management practices. The application of such practices would result in the occurrence of frequent burning regimes to clear land for planting as well as encouraging game by making the land appealing for browsing (Delcourt and Delcourt 1997:1013; Delcourt et al. 1998:267-276).

The use of ceramic pottery became widespread during the Early Woodland. This is indicated by an increase in patterns and tempers in both lowland and upland regions (Bentz 1988:300). The Chapman site is an excellent example of a Middle Tennessee site that spans the

Late Archaic/Early Woodland transitional period. It contained features generally associated with this time period such as post holes, indicating stronger, sturdier structures associated with increased sedentism. Also, there were features identified as storage pits and earthen ovens (Bentz 1986 47-63). Being housed within rockshelter sites, Native American habitation on the UCP generally lack evidence of man-made structures. However, there is an associated history of bedrock mortar holes, petroglyphs, and other similar environmental manipulations (Delcourt et al. 1998:266; Franklin, personal communication).

The Chapman site also contained a variety of plant remains associated with the Eastern Agricultural Complex including squash, goosefoot, and maygrass (Grubb 1986:74). Evidence of those plants associated with the Eastern Agricultural Complex on the UCP has been discussed previously within this paper The lithics present at the Chapman site were identified as common to the Wade and Little Bear Creek clusters (Grubb 1986:74). These forms would later be replaced by the Rounded Base cluster of the Early Woodland (Bentz 1986:140). The presence of these lithics are associated with the dates determined by radiocarbon analysis of features at the site, firmly setting the site within the range of the Late Archaic/Early Woodland transition (Bentz 1986:65, Grubb 1986:74). On the UCP there is evidence of Wade, Motley, Adena, and Little Bear Creek phases among others (Des Jean and Benthall 1994:130-133)

It is clear that overall changes in lifestyle and technology would have left evidence in the palaeoecological/palaeobotanical record. The end of drought conditions would have resulted in the establishment of new settlements away from large water sources. Thus, there would be an increase in the number of archaeological sites dating to this time. Also, the proliferation of ceramic technology would result in abundant ceramic remains. Finally, as the reliance on agriculture for sustenance increases, botanical remains of such food sources should become common in the sediments. Not only would botanical remains abound, but the remains themselves would yield evidence of domestication (i.e. increased seed size, decreased shell thickness, etc.) (Fritz 1997:51). As the Native Americans became more accustomed to agricultural practices, stone tools would display use-wear more appropriately linked to use on plant fibers than animal flesh. Often direct comparisons to lowland sites can be misleading. The landscapes and climates are different. There is no reason to assume the people living in such disparate locations would be the same.

CHAPTER 2
MATERIALS AND METHODS
Study Area

Four sites in the Tennessee region of the UCP were the focus for this project. They are; Eagle Drink Bluff Shelter (W64), Far View Gap bluff shelter (W71), Sachsen Cave shelter (S32), and an intermittent pond. For further clarification see the map provided, Figure 1.

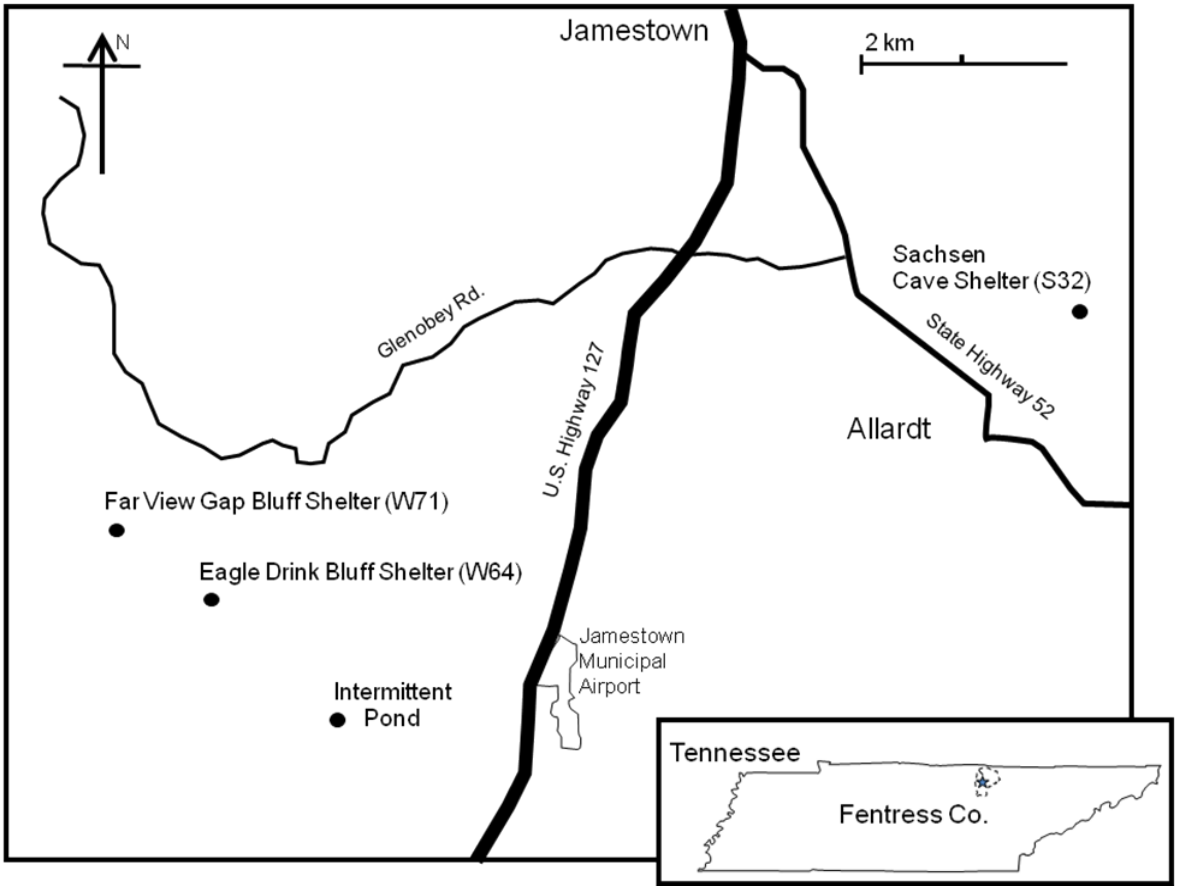

Figure 1. Map showing the location of the various study sites. By Chase W. Beck

All sites are archaeological sites located beneath naturally occurring rockshelters, with the exception of the intermittent pond. The pond is an open air site with no evidence of human habitation.

Floral- and faunal-turbation can make interpreting the results difficult. The effect of such is compounded for this study by both the prehistoric and modern influence of humans. In a study of earthworms it was demonstrated that given sufficient time deposited seeds can be broken down to such an extent that small seeds (< 2 mm) may never appear in an analysis of palaeobotanical remains (Tryon 2006). In extreme cases the effects of bioturbation can be destructive enough to render interpretation highly unreliable if not impossible. In such cases sometimes the best option is to disregard the affected samples (Siesser 1974:29, 31). This is the logic behind the addition of the Pond Site in the analysis. Being a non-habitation site, the rationale was that it would not be subjected to the same kind of human-caused compaction or reworking of the soil. By including the analysis of this site with those of the habitation sites, it was believed that any destructive effects of constant human interaction with the sediments at the sites would become apparent.

Today they are surrounded by mixed mesophytic forests as described by P. and H. Delcourt (Delcourt and Delcourt 1981). All of these sites are in Fentress County, Tennessee. The first site, W71, occurs at 494.55 meters above mean sea level. This bluff is facing due north (map of test unit sampled: Figure 2).

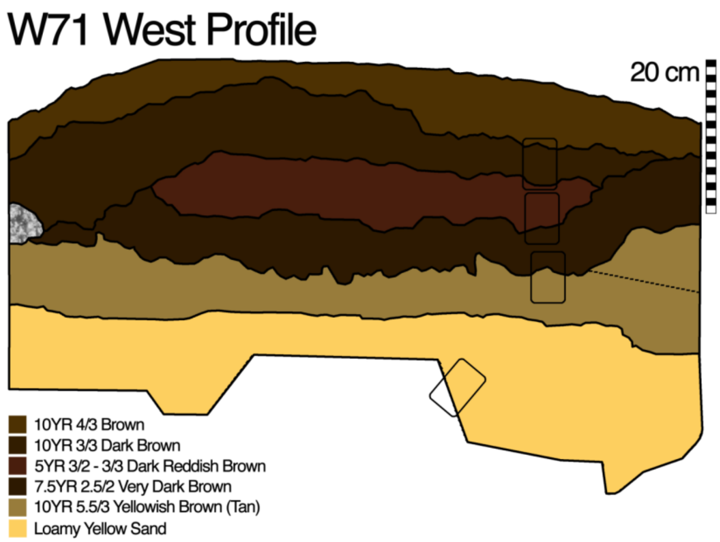

Figure 2. W71 West Profile

The second site, located close by, is W64. Its elevation is 494.163 meters above mean sea level (map of test unit sampled: Figure 3).

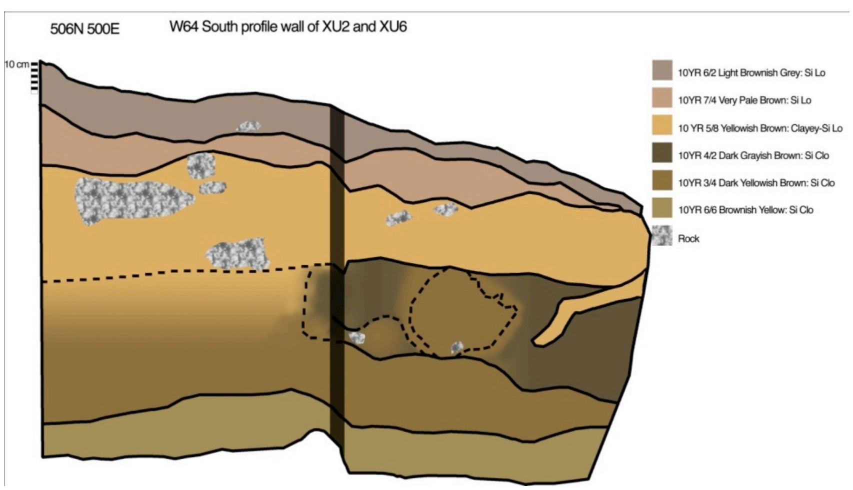

Figure 3. W64 South Profile Wall

Here the bluff faces towards the south east. The third site, S32, is located at an elevation of 482.194 m (Figures 4 and 5).

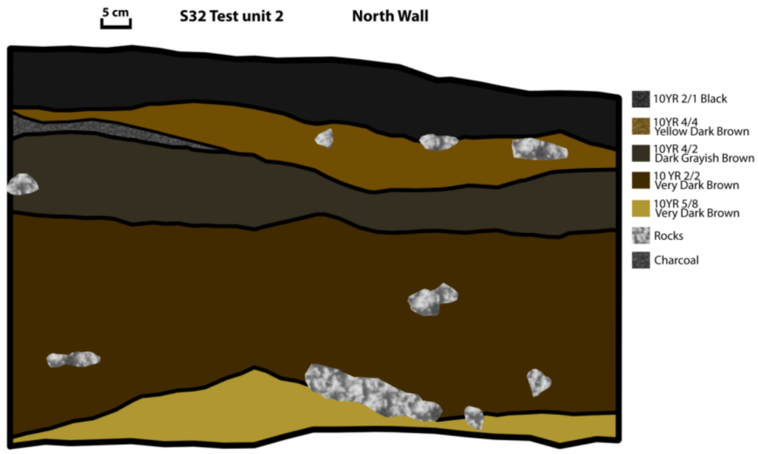

Figure 4. S32 Test Unit 2 North Wall

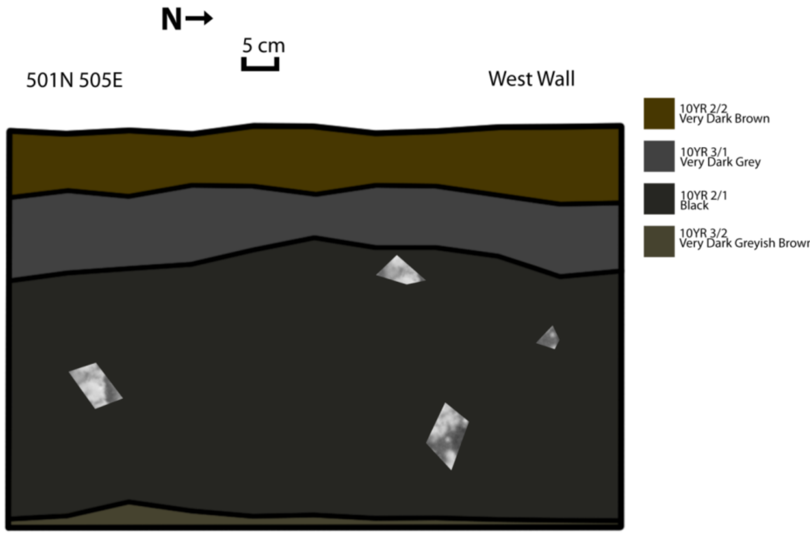

Figure 5. S32 Test Unit 10 West Wall

This shelter opens to the South   The pond that was sampled has an elevation of 511.76 m.

Microfossil

An analysis of indirect evidence was attempted to determine the presence as well as the effect of human land management on the Tennessee region of the UCP. There is evidence of prehistoric, human-controlled burning regimes at sites in the Southeastern United States in such places as Horse Cove and Cliff Palace Pond (Delcourt and Delcourt 1997; Delcourt et al. 1998). The continued existence of the oak-dominated forest in the southeast, as described by Braun (1942) and Stephenson et al. (1993), has been attributed to continued application of controlled burning regimes (Abrams 1992). In Stephenson et al. (1993) , Fontaine in his 1876 study, is quoted as describing the Allegheny Plateau (the northern portion of the same geographic formation that makes up the UCP) of West Virginia as populated with such trees as "white, chestnut, black, and red oaks; chestnut; hickory, (yellow) poplar, ash (*Fraxinus* spp.), sugar maple (*Acer saccharum*), hemlock, beech (*Fagus grandifolia*), locust, and black walnut (*Juglans nigra*)." Stephenson et al. then go on to state that, "of these, white oak seems to have been the single most important species". Later studies cited by Stephenson et al. found similar results, with "beech, sugar maple, red oak, yellow poplar, and white ash" all represented in "relatively undisturbed forest(s)" (Stephenson et al. 1993:262, 272). Abrams wrote that, for the forests on the Allegheny Plateau those left undisturbed since before European colonization were now dominated by beech, maple, and hemlock. The conditions of these forests are likely due to infrequent burning (Abrams 1992:349). Although, these forests were in New York and Pennsylvania, it seems likely that given enough time and little to no human intervention the climax species in the forests of the UCP would be remarkably similar.

Following the collection methods explained by Bryant and Hall (1993) as well as Zavada (2007), sediment samples were collected from sidewalls of test units in W64, W71, and S32. For W64 and W71 one wall of one test unit was sampled every 5 centimeters. In S32 one wall was sampled each from 2 separate test units at the same sampling interval every 5 centimeters. At the pond a trench was dug from which sidewall samples were collected up to 70 centimeters. At 70 centimeters the water level was reached. Later, a barrel auger was used to collect soil below the water level, up to 150 centimeters below the surface. Each sample was approximately 200 g.

These samples were collected for both palynological analysis as well as charcoal analysis. The processing for both analyses was identical and were taken from Zavada (2007). Twenty grams of sediment were measured from each sample into individual plastic beakers. Twenty ml of 10% HCl were added to each sample and left to sit overnight. Afterwards the samples were washed with distilled water 3 times. Then 10 ml of 10% KOH was added to each sample and they were again left to sit overnight. The next day, 10 ml of 5% sodium hypochlorite was added. The samples were once again washed with distilled water 3 times. The samples were then put into individual vials with 10 ml distilled water and labeled. They were then viewed under a compound microscope. All pollen grains and fern/moss spores were identified to the lowest taxonomic rank possible. Kapp (2000) was the primary reference for identification as well as internet palynological databases like the USDA, ARS, APMRU Pollen Lab (USDA, ARS, APMRU Pollen Lab, http://pollen.usda.gov/index.htm 2001).

Macrofossil

Samples for floatation were collected from W64, W71, and S32. Each of these samples was sieved, dried, and viewed under a dissecting microscope. Both W64 and W71 provided sediment samples from features identified in the field. For S32 float samples were collected every 5 cm once undisturbed levels of sediment were reached. Sample sizes range from approximately 1.9 to 3.8 liters. All materials greater than 500µm were retained. Each sample analyzed was separated into large (> 4mm) and small (< 4mm) fractions. The samples were sieved in a U.S. standard #100 sieve (150 microns). Tap water was used to remove any particulate matter from the samples. The remaining materials in the sieve were back-filtered into plastic storage containers for later analysis. The samples were allowed to dry. Identification was made to the lowest taxonomic level possible by aid of a dissecting microscope at 7 to 45x magnification, a compound microscope, when necessary, and a comparative collection. Identification was made possible by use of the appropriate texts (Martin and Barkley 1961; Bonner and Karrfalt 2008) as well as modern analogues. This macrofossil analysis was performed as a method to indicate what was present in the sediment. This analysis was not meant to quantify all of the organic elements present in the samples. In some instances relative abundance was noted especially in comparison to other botanical macrofossil remains present.

Charcoal

Charcoal was identified to lowest taxonomic level possible based on vascular structure present in the carbonized remains. Charcoal was present and identified for samples from W64, W71, and S32. While present in the lake sediments the charcoal was too highly fractionalized to make identification possible. The appropriate references, such as <u>Identifying Wood: Accurate Results With Simple Tools</u>, were useful in identifying these fragments (Hoadley 1990). It requires stating that the absence of certain taxa in the identification only indicates that it was not present among the charcoal identified. It is quite possible that numerous species of trees were present in the flora of the immediate area but in such low numbers as to not register. It is also possible that the identified carbonized wood represents the preferences of the Native Americans in burning materials rather than actual forest composition at the sites (Delcourt et al. 1986:346). Chapman has outlined 5 assumptions for interpreting wood-charcoal samples when they are encountered in such situations. These assumptions are: "(1) the wood was gathered primarily for fuelwood; (2) the wood was collected from the area within a 1-km radius of the individual residential sites; (3) collection of fuelwood by Indians was not biased toward particular tree species; (4) the tree taxa represented in the wood charcoal samples were forest dominants or subdominants; and (5) the relative importance of arboreal taxa have not been biased by differential fragmentation of the wood charcoal." (Chapman et al. 1982:117). In this instance it is necessary to assume that any charcoal found inside any of the rock shelter sites is the result of human habitation. This is not to suggest that wood found in these sites does not represent trees present in the immediate area, only that they do not necessarily represent the composition of the vegetation in the immediate area

The charcoal remains were also analyzed using the protocol described in "Tracking Recorded Fires Using Charcoal Morphology From the Sedimentary Sequence of Prosser Lake, British Columbia (Canada)" (Enache and Cumming 2005). Pictures were taken of the processed sediment under a compound, light microscope. These pictures were digitally manipulated to correct exposure as well as increase the contrast between the charcoal and other substances. Finally, a program called ImageJ was used. This program allows the dark spots (charcoal) in the images to be measured for percentage area covered or the total area of the picture covered by charcoal. This method was taken from an unpublished paper by Alexander Correa-Metrio. It was devised to minimize human bias. It was used in lieu of an older method. In previous studies counting the number of charcoal pieces organized by size was used to estimate distance of travel from the source (Delcourt et al. 1998:268).

In a 2005 study Enache and Cumming categorized charcoal into 7 distinct morphotypes. From this study they determined that 2 of the morphotypes were positively correlated to the occurrence of fires. These charcoal types were labeled type "M" and type "C". Type M charcoal indicates hot fires that burn primarily leaves and branches. Physically type M charcoal fragments appear thin and have an irregular shape and irregular porosity. Type C charcoal is left when wood and bark have been burned. It has an angular-irregular geometric shape and no porosity (Enache and Cumming 2005:282-285).

Enache and Cumming's study correlated both type M and type C charcoal with an area with a known fire history. Type M charcoal was found to be the best indicator of local and regional fires. The presence of type M charcoal indicated the occurrence of fires within a 20 km radius of the area studied. Additionally, type M charcoal was never found as a false positive over all locations and depths studied. This means that it was never present at a depth that did not correlate to a recorded fire. It was speculated that this is due to the fragile nature of type M charcoal. Due to this fragility, it is unlikely that type M charcoal would survive secondary transport. Type C charcoal was found to indicate the actual location of such fires. The same cannot be said, however, for type M charcoal.   Type C charcoal, being quite dense and compact, is often less likely to be transported. In summary when type M charcoal appears in a stratum it is indicating time of occurrence of a fire. When type C charcoal appears in a stratum, it indicates location of a fire. However, Enache and Cumming studied only large-scale, fairly recent fires. The Enache and Cumming study demonstrated that analyzing charcoal types is much more accurate than measuring charcoal amounts alone. For the sites in the Tennessee region of the UCP that the present study covers charcoal types as well as total percentage cover of charcoal were used in sediment analyses.

It also bears mentioning that a relationship between the presence of type C and type M charcoal was noticed during the course of this study. It was found that there was rarely an increase in type M charcoal in a sample without a corresponding increase in type C charcoal. Additionally, type M charcoal was never present in the absence of type C charcoal. This relationship is not recorded in Enache and Cumming's study although a relationship between type S and Type C is discussed. Finally, no attempt was made to demonstrate said relationship between type M and type C charcoal with statistical evidence.

Radiocarbon and Sedimentation Rate

Radiocarbon dating was performed on various charcoal samples from every site. W71 had 3 samples for radiocarbon dating (see Table 1), W64 had 4 samples for radiocarbon dating (See Table 2), S32 had 6 samples for radiocarbon dates (see Table 3), 4 from TU2 and 2 from TU10. Finally, the pond site had 7 radiocarbon dates performed (see Table 4).

Table 1. Radiocarbon Dates from Far View Gap Bluff Shelter (W71)

Provenience	Depth below surface	Description	Measure
TU7 sidewall	5cm	Charred material	3380±40 yrs. BP
TU7 sidewall	20cm	Charred material	1540±40 yrs. BP
TU7 sidewall	25cm	Charred material	1540±40 yrs. BP

Table 2. Radiocarbon Dates from Eagle Drink Bluff Shelter (W64)

Provenience	Depth below surface	Description	Measure
TU 6 sidewall	15cm	Wood charcoal	Modern
TU6 sidewall	45cm	Wood charcoal	2880±40 yrs. BP
TU6 sidewall	60cm	Wood charcoal	1060±40 yrs. BP
TU6 sidewall	80cm	Wood charcoal	5240±40 yrs. BP

Table 3. Radiocarbon Dates from Sachsen Cave Shelter (S32)

Provenience	Depth below surface	Description	Measure
TU2 sidewall	0cm	Wood charcoal	Modern
TU2 sidewall	20cm	Wood charcoal	807±40 yrs. BP
TU10 sidewall	20cm	Wood charcoal	3363±37 yrs. BP
TU2 float	35cm	Wood charcoal	3385±41 yrs. BP
TU2 sidewall	45cm	Wood charcoal	4379±45 yrs. BP
TU10 sidewall	50cm	Wood charcoal	5995±42 yrs. BP

Table 4. Radiocarbon Dates from Ephemeral Pond

Provenience	Depth below surface	Description	Measure
From sidewall	15cm	Seeds	Modern
From sidewall	20cm	Wood charcoal	4596±50 yrs. BP
From sidewall	35cm	Wood charcoal	3390±100 yrs. BP
From sidewall	45cm	Wood charcoal	Modern
From sidewall	60cm	Wood charcoal	1556±40 yrs. BP
From sidewall	65cm	Wood charcoal	4492±44 yrs. BP
From core	110cm	Wood charcoal	6031±72 yrs. BP

Samples from S32 and the Pond Site were processed by the NSF Accelerator Mass Spectrometry Facility at the University of Arizona. All of the samples from W71 were processed by Beta Analytic Inc. The samples for W64 were divided between the 2 facilities. The samples from 15cm bs was processed at Beta Analytic Inc. The remaining samples from W64 were processed by the NSF Accelerator Mass Spectrometry Facility at the University of Arizona. After receiving the radiocarbon dates, the various dates were evaluated for accuracy as well as appropriateness. Some were retained while others were ignored for reasons such as being chronologically invalid. The retained radiocarbon dates were used for determining an average sedimentation rate for each site.

CHAPTER 3
RESULTS
Radiocarbon and Sedimentation Rate

The shallowest sample from W64 was 15cm bs. The sample suggested a modern date, indicating that all sediment above it would read the same. A sample 45cm bs yielded the date: 2880±40 yrs. BP. At 60cm the sample was aged at 1060±40 yrs. BP. Finally, the last year recorded for the site was at 80cm bs. This sample came out to be 5240±40 yrs. BP. There is an apparent incongruity with the dates. When compared to the thermoluminenscence and radiocarbon dates attained by Franklin, it becomes apparent that there is reworked sediment at this site (Franklin 2008:95) The dates from 15cm, 45cm, and 80cm were retained whilst the date from 60cm was disregarded. Using the dates previously mentioned, the sedimentation rate of .14 mm/yr. was determined.

W71 produced a date of 3380±40 yrs. BP for a sample that was collected 5cm bs. Samples collected for thermoluminescence dating at the same site provided slightly younger dates, from ≈2799-3058 yrs. BP (Franklin 2008:92). Samples from 20cm and 25cm bs in the same test unit yielded identical radiocarbon dates: 1540±40. Such discrepancies point towards the conclusion that a fair amount of reworking has occurred at the site. Ultimately, the date from 5cm was ignored and the dates from 20cm and 25cm were used to establish the chronology of the site. Due to a lack of other dates, the depositional rate calculated from W64 (.14 mm/yr) was applied to W71. Thus, no sedimentation rate was decided upon specifically for this site.

The S32 site had 2 locations from which samples for radiocarbon dates were collected. Test Unit 2 (TU2) had 4 samples and test unit 10 (TU10) had 2 samples. The surface sample from TU2 indicated modern sediments. The next sample, collected from 20cm bs, indicated an age of 807±40 yrs. BP. At 35cm bs, the sample returned a date of 3385±41 yrs. BP. The final sample from TU2, 45cm bs, returned with a date of 4379±45 yrs. BP. Of the 2 samples collected from TU10, the first was from 20cm bs, and the second was from 50cm bs. The samples provided the dates 3363±37yrs. BP, and 5995±42 yrs. BP, respectively.

For TU2 it was determined that the sample from 20cm bs did not fit chronologically with the other dates and was thus ignored. When attempting to find the proper position chronologically for TU10, it was noticed that the charcoal graphs for both TU2 and TU10 were nearly identical except, TU10's graph appeared to be offset by several thousand years. To compensate for this discrepancy, an arbitrary number of years (2500) was subtracted from the 2 radiocarbon dates available for TU10. This aligned the graphs from TU2 and TU10 in a more appropriate manner. TU2 seemed the more likely column to base dates off of in that 1. It had the most points of data and, 2. it better matched the date range previously established for sites W71, W64, and the Lake site than TU10 did. The dates from TU2 provided a sedimentation rate of .1 mm/yr. while the dates from TU10 indicated a rate of .11 mm/yr.

The Pond Site had radiocarbon dates taken from 15cm bs, 20cm bs, 35cm bs, 45cm bs, 60cm bs, 65cm bs, and finally 110cm bs. Both the samples from 15cm bs and 45cm bs yielded dates that indicated they were modern. This indicates significant turn-over in the sediment of the site and thus the 2 radiocarbon dates from between those samples 20cm and 35cm, were not used in determining the chronology of the site. The sample from 60cm bs gave the date 1556±40 yrs. BP. The next sample, 65cm bs, gave the date 4492±44 yrs. BP. Finally, at 110cm bs, the sample indicated the date of 6031±72 yrs. BP. These dates allowed for the conclusion that the average sedimentation rate at this site was .11 mm/yr. These determinations of sedimentation rate made possible by the abundant radiocarbon dates allow for a chronological alignment of the samples from various sites. In this way not only can dates be applied to the various samples, but also the sites can be compared to one another based on respective dates.

Microfossil

Of the various samples collected and processed for analysis, several were devoid of pollen. In many instances where pollen was present it was in poor condition. It is possible that the conditions in the soil did not support pollen preservation. Pollen analyses were attempted for W64, W71, or S32 although ultimately they were not possible. The ephemeral pond site proved slightly better for providing pollen data (see Table 5). While several samples were devoid of pollen, a few contained identifiable pollen grains. Only 2 samples actually contained high enough densities to provide a count ≥100 pollen grains. The first of these samples was taken from the surface and the second was approximately 80 cm below the surface (bs). They correlate to 0 yrs. BP and ≈ 3300 yrs. BP, respectively.

The modern sample showed high amounts of both wild and domesticated grasses (Poaceae). It constituted nearly a third of all pollen present at that level. The other most common pollen present was identified as fir (*Abies* sp.). It made-up ≈ 12% of the total pollen found at that level. While firs are not naturally found in this area, the presence is not surprising given the planting practices of local inhabitants. Additionally, it would not be surprising if further study revealed the presence of a nearby Christmas tree farm. The remaining pollen was divided between deciduous taxa. These include Liriodendron and Magnolia, pterophytes, and nonwoody plants and shrubs (Sanguinaria and Berberidaceae).

In the 80cm below the surface (bs) sample Pine (*Pinus* sp.) was the most common at 29%. Uncultivated grasses were also common (14%). Many more deciduous taxa were represented like elm (*Fagus* sp.), oak (*Quercus* sp.), sweet gum (*Liquidambar* sp.), and hickory (*Carya* sp.). All in all, the pollen from ≈3300 yrs. BP indicates a more diverse forest assemblage, although it is apparent from even a cursory investigation that there are plants present in the modern local flora that do not register as pollen in this analysis. Finally, both of these pollen assemblages reflect the data provided from nearby studies (Delcourt 1980; Delcourt et al. 1998).

As for the other levels, pollen was sparse but of what was present and identified shows a relatively long history of diverse forest composition. The earliest identified members were *Liriodendron* sp., *Magnolia* sp., and *Calycanthus* sp. from ≈9610 yrs. BP. *Calycanthus* sp. or sweetshrub was not reported in the Cliff Palace Pond nor the Anderson Pond study. Both *Magnolia* sp. and *Liriodendron* sp. are reported at Cliff Palace Pond but at a much later date. Anderson Pond does not list *Liriodendron* sp. at any depth but *Magnolia* sp. is present at Anderson Pond, at a depth coinciding to an older date than reported at the Pond Site in this study.

The next identifiable species from the Pond Site were *Quercus* spp. (oak) and *Nymphaceae* sp. These were first found at depths correlating to ≈7821 yrs. BP. Because *Nymphaceae* sp. is a family of aquatic plants, this provides an indication of the water levels of this region of the plateau during this time. Also, because *Nymphaceae* sp. is nonarboreal pollen, it's likely from rather close by, even possibly the ephemeral pond itself. This could be an indication that the pond was far less ephemeral at this time. *Nymphaceae* sp. is present in Anderson Pond as "nuphar", as far back as ≈15000 yrs. BP as are multiple other aquatic species.

As for Cliff Palace Pond multiple marshy/aquatic taxa such as Typha (cattail) and Sparganium (bur-reed) are listed for as far back as ≈9500 yrs. BP.

At about 6900 yrs. the first presence of pine is detected at the Pond Site. *Liriodendron* sp. is again present as well, as is the first evidence of a chenopod. Both Cliff Palace Pond and Anderson Pond list pine present in the oldest samples (9500 and ≈19000 yrs. BP respectively). It is just as likely that pine was also present in the Tennessee region of the UCP but, due to the afore-mentioned poor pollen preservation was not identified until this time. Goosefoot (*Chenopodium* spp.) is present at a similar age at Cliff Palace Pond but was never detected at Anderson Pond.

Dogwood is first detected around 6000 yrs. BP at the Pond Site. This is shortly after the Anderson Pond date of ≈9000 yrs. BP. Also, it is slightly before the date listed for Cliff Palace Pond (≈3000 yrs. BP). At around 5100 yrs. BP ferns and wild grasses are first detected in the ephemeral pond sediments. Anderson Pond reports grasses from the beginning of sampling as does Cliff Palace Pond (≈25000 and ≈9500 yrs. BP, respectively).

At around 2400 yrs. BP another aquatic plant (*Cabomba* sp.) is detected in the sample from the Pond Site, indicating once again, that it could still maintain a healthy aquatic population. Soon after (≈2000 yrs. BP) *Nyssa* is detected at the Pond Site. Anderson Pond has a record of this plant as far back as ≈9000 yrs. BP, Cliff Palace Pond, about 8000 yrs. BP. In the upper depths of the ephemeral pond sediments the pollen data becomes difficult to interpret, likely due to eutrophication of the pond as well as frequent drying and flooding. The effects of land clearing are probably also to blame for the unclear history after this point. Some aquatics are still present (*Cabomba* and Haloragaceae) as well as mosses. Shrubs such as *Crataegus*, *Viburnum*, and *Halesia* and trees like Redbud (*Cercis* sp.), are first identified at this time. Additionally, wildflowers such as soapworts and poppies appear within these last few levels as well as an unidentified *Asteraceae* sp.

Multiple pollen spores reappear over the course of the sampling at the Pond Site. A more nearly complete record would provide an indication of whether these are in fact reappearances or rather indications of a continuing population within the region at the site. *Nyssa* (likely blackgum), *Chenopodium*, *Quercus*, *Liquidambar*, and grasses (both wild and domestic) all share the distinction of appearing multiple times throughout the sediment column as do magnolias and ferns.

Charcoal

Using the radiocarbon dates and sedimentation rates it was possible to align the charcoal data chronologically. When looking at total charcoal cover, some patterns do emerge (see Fig. 6).

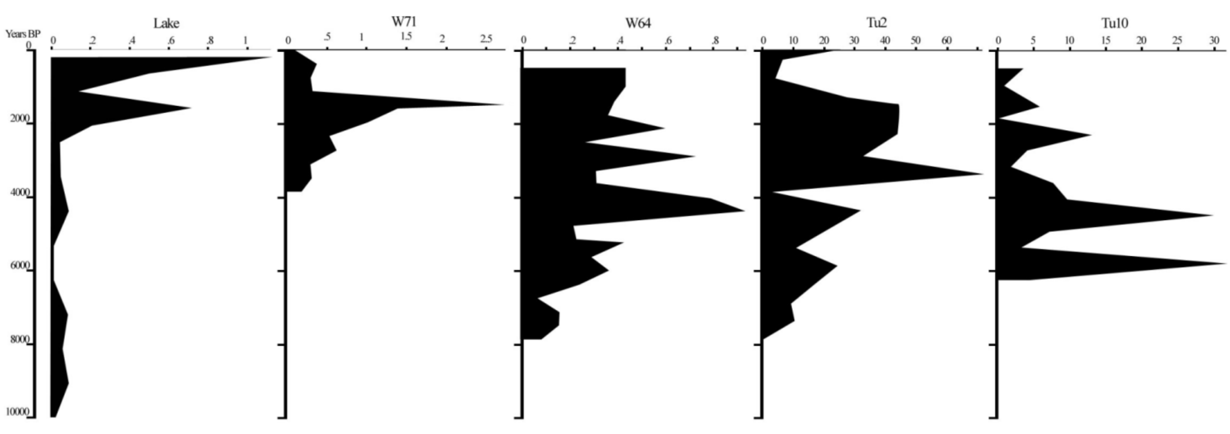

Figure 6. Total percentage cover of charcoal. All sites are represented on separate percentage cover scales

At ≈1500 yrs. BP there is a peak in charcoal that can be seen in the lake graph, W71, and both of the graphs for S32. Another peak in charcoal that registers at multiple sites occurs at

≈4500 yrs. BP. This increase in charcoal abundance occurs in the lake graph, W64, and both of the graphs for S32. Around 7300 yrs. BP there is a peak that is present in the pond graph, W64 graph, and one of the graphs in S32 (TU2). The other sample site at S32 (TU10) does not have samples from that long ago. There is also a peak at ≈6000 yrs. BP. This peak is shared between W64 and both S32 sites. There are various peaks that are only present in one or 2 sites.

Type M and C charcoal were measured at every site (Fig. 7 and Fig.8 respectively). Both type M and C charcoal were found at their greatest abundance at both test units in S32.

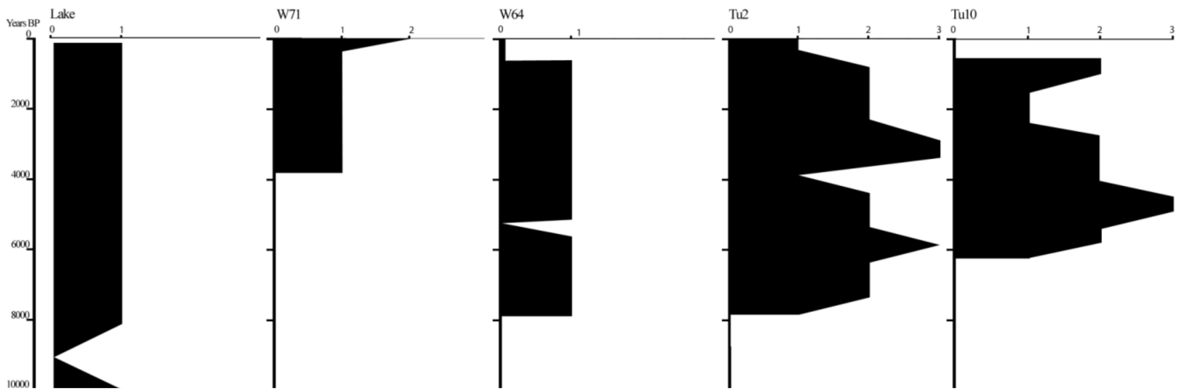

Figure 7. Type C charcoal. All sites are represented on the same scale. 0= not present, 1= present, 2= common, 3= abundant. see text for further clarification.

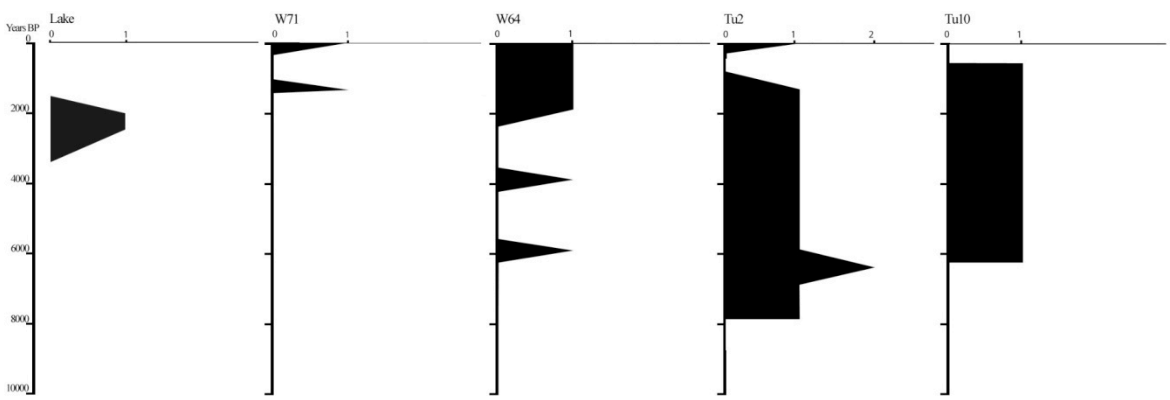

Figure 8. Type M charcoal. All sites are represented on the same scale. 0= not present, 1= present, 2= common, 3= abundant. see text for further clarification.

While type C charcoal was present at W71, W64, and the Pond Site, their levels were much lower at each. Type M charcoal was detected at every site. The S32 sites show both greater levels and a more sustained presence of this charcoal type. W64, W71 and the Pond Site show limited peaks. The Pond Site shows one peak covering a 500 yr. period from about 2000 yrs. to 2500 yrs. BP. W71 displays 2 peaks. One is modern. The other peak is at about 1500 yrs. BP. W64 displays 2 peaks at ≈6000 yrs. BP and ≈5000 yrs. BP. It also displays a plateau of type M charcoal beginning at about 2000 yrs. BP and lasting until modern times.

Macrofossil

Macrofossil samples for W71 were collected from visible features. As a result charcoal was abundant for identification. Oak (*Quercus* sp.) and pine (*Pinus* sp.) were present (Fig. 10; #2 & #3). There were also a few nut fragments present. Hickory shells were the most common, although, walnut and acorn shells were also present (Fig 10; #8,#9, & #10). A seed fragment was also found that later identified as raspberry-like (cf. *Rubus* sp.) (Fig. 10; #7). It was not carbonized. Carbonized plant material is often associated with Native American sites (Hally 1981:733-734). The lack of carbonization is significant in that it makes the seed fragment just as likely to have been deposited by an animal as a human inhabitant.

In W64 abundant charcoal was also present for identification. Like W71 it contained oak (*Quercus*) and pine (*Pinus*) (Fig. 10; #2 & #3). Additionally it contained maple (*Acer*), chestnut (*Castanea*), and mulberry (*Morus*) (Fig. 10; #4 & #5, mulberry not pictured). A seed coat was found in one of the W64 samples but it was not identifiable. Once again nut shell fragments were present for hickory, walnut, and acorn (Fig. 10; #8, #9, & #10). Hickory was once again the most common. But neither W71 nor W64 had terribly abundant nut shell fragments.

No visible features were found in S32. As a result samples were taken at 5cm increments. Each sample contained carbonized wood. The best pieces for identification were selected from 20cm, 45cm, and 50cm bs. These carbonized wood fragments were identified as oak and gymnospermous wood (likely pine). The samples in S32 indicated a much higher concentration of nut shell fragments. Acorns, hickory, and walnut nut shell fragments were present in these samples (Fig. 10; #8, #9, & #10). The wood types and botanicals present at each site were very similar in type but not in amount, ratio, or density.

CHAPTER 4
DISCUSSION
Radiocarbon and Sedimentation Rate

The sedimentation rates of all of the sites were quite low. This could indicate very little erosion in the immediate area, likely a result of abundant vegetation acting as ground cover preventing said erosion. It is possible that were land clearing practices to have taken place on the UCP, the average sedimentation rates at the various sites would have been much higher. Higher sedimentation rates has been suggested to reflect both natural changes in vegetation as a result of climate change and increased human activity (Xu 1998:71-75). Such a study was undertaken in Southern New England within the Narragansett Basin. From that study it was found that sedimentation rates within the Narragansett Basin increased from an average of .02 mm a year during precolonial times to an average of 2.8 mm a year as a reflection of industrialization. In fact the highest sedimentation rate of all precolonial samples studied was .1 mm/yr. When compared to the colonial and modern samples the differences in sedimentation rates were quite startling (Ricker 2010:2, 20-21, 43). There is an apparent correlation that can be drawn between that study and this current study. Like the precolonial sedimentation rates within the Narragansett Basin, a very slow sedimentation was determined for the sites studied herein. This would imply that there was very little disturbance/land clearing occurring in the Tennessee region of the UCP. A greater number of radiocarbon dates per site might have aided the interpretation of sedimentation rates, although in several instances radiocarbon dates were rejected for not matching chronologically with other radiocarbon dates.

Microfossil

Although the pollen data from the samples taken from the various sites were sparse, the data provided by the previously mentioned studies (Delcourt 1980 and Delcourt et al. 1998) can allow for speculative insight into what was happening in the Tennessee region of the plateau during this time. Cliff Palace Pond, while over 150 km from the Tennessee Study sites, still rests on the plateau at a similar elevation (Delcourt et al. 1998:264). The Anderson Pond site is much closer (≈60 km), but it is off of the plateau (Delcourt 1980:257). The Anderson Pond site might be a better site than it initially appears because its location puts a portion of the Tennessee UCP within the drainage of Anderson Pond although not the sites featured in this particular study. Thus, pollen data from the Tennessee region of the UCP would make its way to Anderson Pond. It is impossible though to separate the UCP pollen from pollen deposited from other areas in the drainage. Additionally there is a danger that any pollen data directly from the UCP could be obscured by such pollen from the other regions represented, particularly the area surrounding Anderson Pond. It becomes apparent that both sites must be analyzed in conjunction to come to a conclusion on the nature of the Tennessee study sites.

Around 9,500 yrs. BP the Anderson Pond site was a well established mixed-mesophytic forest. The Cliff Palace Pond samples on the other hand show an area dominated by a boreal forest (Delcourt 1980:267; Delcourt et al. 1998:274). It can be assumed that during this time the Tennessee UCP was transitioning between the 2 biomes. The presence of magnolia and tulip poplar in the sediment from the Pond Site correlating to this time seems to support this. By 8,000 yrs. BP the Cliff Palace Pond area was just beginning its transition from a boreal forest to a mixed mesophytic forest. The Tennessee UCP could have already been a well established and diverse mixed-mesophytic forest. Again, this is supported by the presence of oak in the pollen analysis from the Pond site. From around this time until about 4,800 yrs. BP there is evidence of a storm track displacement in southeastern Kentucky (Delcourt 1979:370; Delcourt et al. 1998:274). It is not out of line to assume that these conditions could have extended into the Tennessee region of the UCP. Increased precipitation would have increased the presence of water-tolerant plants while minimizing the presence of xeric taxa (oak, hickory, ash) on the plateau. While it is not known whether hemlock was abundantly present in the Tennessee UCP, there is evidence of an infestation that caused a die-off of hemlock in Kentucky 4,800-3,000 yrs. BP (Delcourt et al. 1998:275). Hemlock is not present in the Anderson Pond samples after ≈5,000 yrs. BP, although it does return albeit shortly at ≈4,000 yrs. BP (Delcourt 1980:264, graph). The present study of charcoal in the Tennessee UCP shows a drastic, multi-site increase in charcoal around 2,500 yrs. BP. Whether this is a result of similar conditions to that seen in the Cliff Palace Pond area is unknown. But it is possible that this could have resulted from similar conditions to those that eventually led to the introduction of horticulture/agriculture at Cliff Palace Pond (Delcourt et al. 1998:275-276).

Based on the speculation made possible by the Cliff Palace Pond and Anderson Pond studies around 3,000 yrs. ago the Tennessee region of the UCP would likely be a rather dense oak dominated mixed-mesophytic forest. The pollen data from the ephemeral pond show an abundance of deciduous taxa (Carya, Fagus, Liquidambar, Quercus, etc.), some even reappearing multiple times within the incomplete column. While it would be unwise to give the pollen data of this study too much weight given the lack of a complete record, multiple identified species are present in the Cliff Palace Pond and Anderson Pond sediments. Such results are to be expected, although the presence of aquatic species at early dates (as early as ≈7800 yrs. BP) could indicate a much more permanent water source. Additionally, the continued reappearance of *Chenopodium* spp. pollen (a member of the Easter Agricultural Complex) certainly suggests the possibility of horticulture/agriculture in the immediate area. Given the quality of the pollen record as well as the lack of supportive (macrofossil) evidence, it seems unlikely.

Charcoal

When evaluating charcoal peaks it would seem likely that peaks that occur within one site and do not present any chronological correlation to peaks at other sites are local or hearth fires. Those peaks that are shared over several sites can be assumed to be either fires on a much larger scale or evidence of increased usage/habitation of the area studied. The Pond Site becomes useful in this analysis as being a nonhabitation site increases in activity exclusively at habitation sites would not register. In opposition to that view the Pond Site does lie near to a bluff shelter site that does contain evidence of Native American occupation during precolonial times. Thus, the peaks in total charcoal occurring at ≈1500 yrs. BP,≈4500 yrs. BP, and ≈7300 yrs. BP could indicate large fire events. The peak occurring in multiple sites at ≈6000 yrs. BP, because it does not register at the Lake site, could indicate an increase in activity but not necessarily a large-scale fire. A recent study (Hart et al. 2008) attempted to address fires on the UCP by viewing macrofossil charcoal from various core samples. Their study provided uncalibrated dates of 201 ± 31, 1585 ± 33, 2046 ± 33, 3216 ± 35, and 5913 ± 40.

At least 2 of those samples (1585 ± 33, 5913 ± 40) seem to agree with the results from this current study. Additionally, it would seem to indicate that the ≈6000 yrs. BP peak while not reflected in the ephemeral pond sediments may be a larger scale fire than initially observed. The

Hart et al. study was undertaken in an effort to show the existence of multiple small-scale fires, but the dates shared between that study and the current study seem to suggest a much larger conflagration, several small fires, or at least, abundant activity on the plateau during those times. While the evidence is quite clear that multiple large-scale fires occurred, it also suggests that these fires were few and far between.

Total charcoal levels show the highest percentage cover of charcoal at both S32 proveniences studied. This could indicate the highest levels of activity of all the areas studied. The amount of type C charcoal at these sites by surpassing the amount found at the other sites certainly supports this idea. The levels of type C charcoal at the other sites, W64, the pond, and W71, are rather unremarkable. The graphs for type M charcoal are equally unremarkable overall. Although when looking at W64, W71, and both test units in S32 it becomes clear that in most instances type M charcoal is present at all sites throughout most if not all depths studied. This could suggest that for this study type M charcoal is measuring immediate human habitation. If such is the case, it establishes a long history of human habitation at all of the sites. In reality the presence of type M charcoal has never been demonstrated to represent such evidence. The Pond Site, however, only shows one peak in type M charcoal. This indicates an event or several events that occurred over an extended period of time. The lack of an increase in type C charcoal at the same site suggests that the event did not occur at the Pond Site. Unfortunately, there are no corresponding peaks in charcoal at any of the other sites studied, although both TU10 and TU2 show activity at a sustained level. A graph including all of the charcoal and pollen data was prepared and can be found at the end of this paper (Figure 9).

Macrofossil

Based on the macrofossil charcoal identification it would appear as if forest composition is nearly ubiquitous throughout all of the sites (dominated by oak and pine). The presence of oak charcoal could suggest a forest subject to periods of drying and occasional fires. In fact today oaks are being replaced in forests they have long dominated by other species (Abrams 1992:346, 351). Certain species of pine are adapted to fires as well and can survive in a similar manner to oak (Delcourt and Delcourt 1997:1010). The wood charcoal likely came from hearth fires within the sites where they were found. It is useful in indicating the presence of species within the region but because the presence of wood charcoal reflects human preference, it is not intended to be a direct representation of local tree taxa (Delcourt et. al 1986:346). Regardless, the presence of oak and pine is sufficient to suggest that they were fairly common. The absence of those species associated with a climax forest (maple and hemlock) would suggest that the Native Americans employed a burning regime that prevented the forest from developing into a climax forest extending the transitional phase of the forest beyond its natural length of time (Abrams 1992:346, 349, 351; Stephenson et al. 1993:262, 272). The abundant nut shell fragments, particularly at S32, where multiple grooved stones often associated with nut processing were found, suggests that in addition to animal meat, natural nut resources were also used by the Native Americans at this site to make-up a large portion of their diet The absence of plant macrofossils associated with the Eastern Agriculture Complex would suggest that if they were consumed, they were not produced in this region of the UCP.

CHAPTER 5
CONCLUSION

Initially the purpose of this study was to address various questions concerning the subsistence patterns of Native Americans living on the UCP. When did they begin controlled burns? What was the extent of land management on the plateau and what vegetation changes occurred on the plateau as a result? Did this land management develop into horticulture and if so when?

The sedimentation rates determined for the sites in Tennessee matched those found for the sites studied within the Narragansett Basin (Ricker 2010:2, 20-21, 43). Such results would suggest similar environmental factors, the most likely of which being extensive vegetation cover. This indicates that Native Americans within the Tennessee region of the UCP undertook activities that had a very low impact on the local, long-term vegetation cover.

The charcoal analyses, both distribution and type, were undertaken to provide data on Native American occupation of the UCP. In particular, the study attempted to address the duration of habitation and level of intensity of occupation in this region. The data suggest that S32 was used longer and more intensely than both W64 and W71. This indicates that S32 was of greater interest to the Native Americans and supported a larger population than either of the 2 other sites. All of the sites provided charcoal data that show evidence of multiple, simultaneous fire events. But due to the low frequency of occurrence and randomness of events, it would seem as if fire was not used to manage the local vegetation and natural resources as intensively as other UCP sites such as Cliff Palace Pond (Delcourt et al. 1998:263-264, 274-276). It is even possible that these events were legitimate wildfires.

Additionally, the presence of agriculture in this region would seem unlikely. The abundant nutshell fragments as well as artifacts useful in processing such material suggests that nuts were a major resource in the region. The nutrients and calories available to the Native Americans provided by these resources would have been collected during the fall season. However, artifacts and remains found at the sites strongly suggest that this region was also used for hunting purposes.

Based on the findings of the study the usage of the sites would have been seasonal and of a necessity connected to the fall season. However, this is not to suggest that the sites could not have been used by Native American inhabitants during other seasons as well. Additionally, while it becomes apparent that certain sites were used more intensely, for longer periods, and for certain activities, agriculture was not one of those activities. That Native American inhabitants might have permanently settled these sites and lived exclusively in the UCP is not supported by these findings. However, neither is such a theory fully refuted by these findings.

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APPENDIX

Additional Figures and Tables

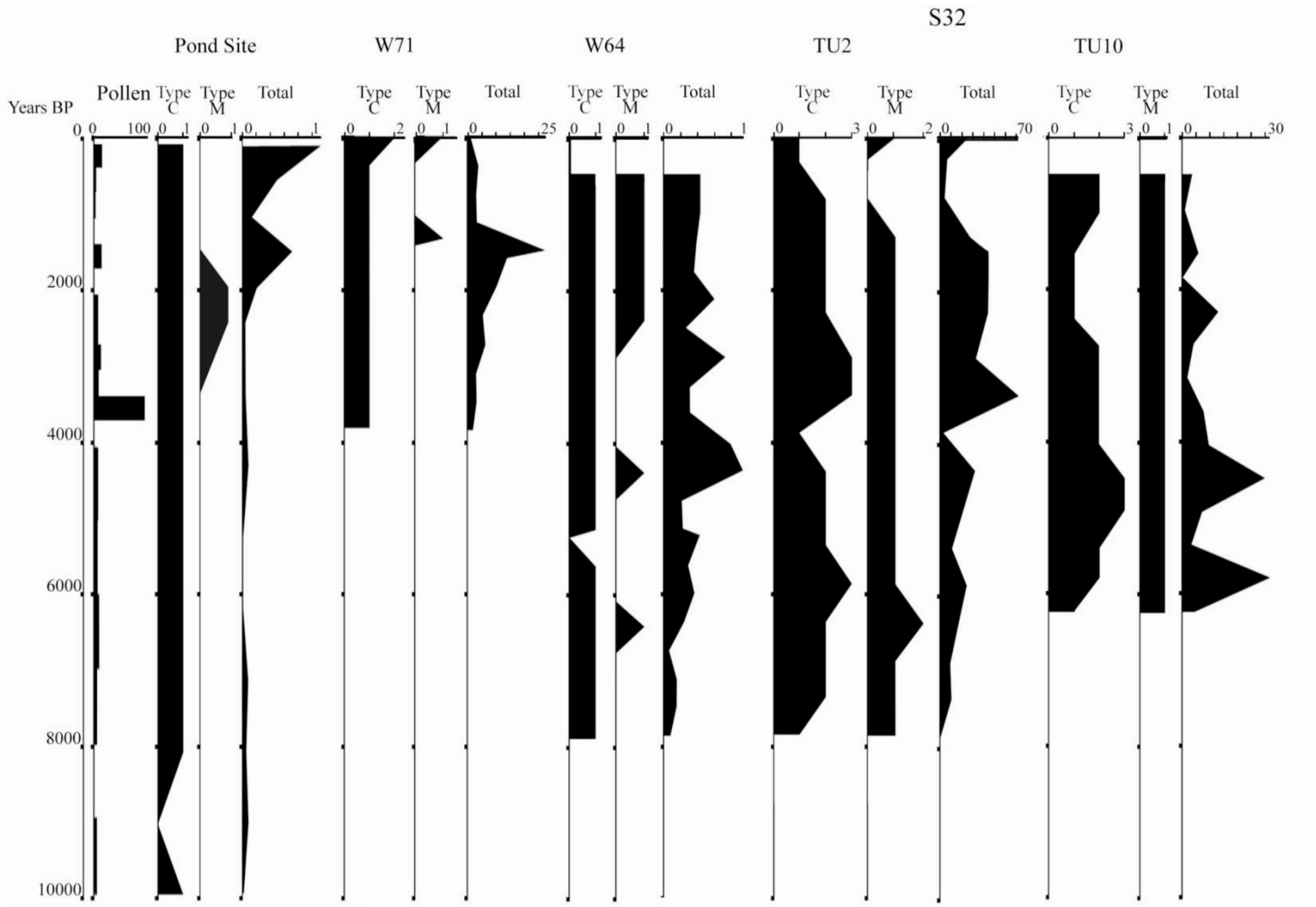
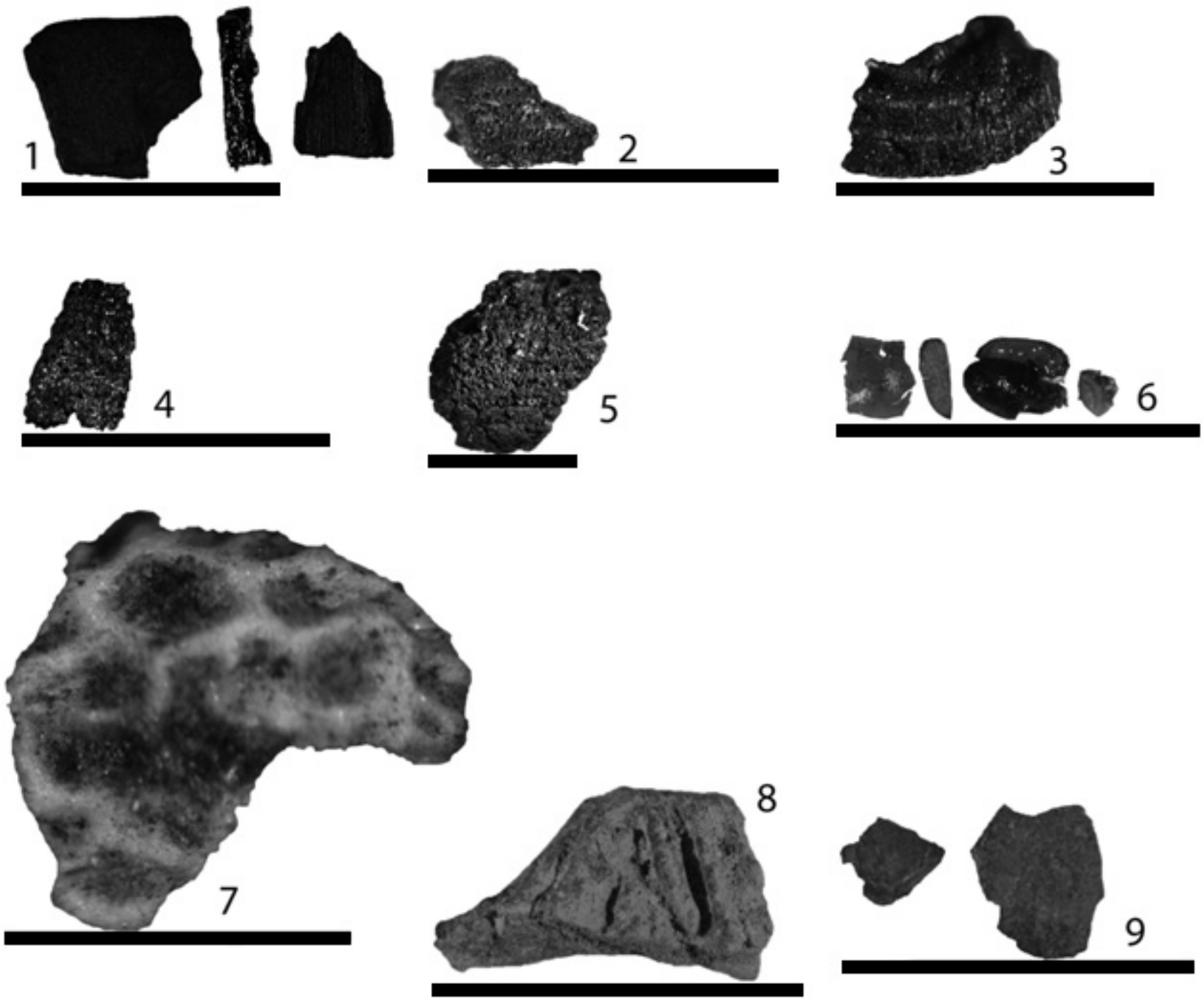


Figure 9. Combined graphs of the pollen count from the Pond Site, and Type M, Type C, and Total charcoal amounts for the Pond site, W71, W64, and S32.

TABLE 5. Pollen Data from the Pond Site Continued

Estimated Date (in yrs. BP)										0	519	1037	1556	2004	2452	3347	4242	5136	6031	6926	7821	8715	9610
Depth (in cm)		5	10	15	20	25	30	35	40	45	50	55	60	65	70	80	90	100	110	120	130	140	150
Total Pollen Count		97	7	53	39	15	3	2	0	14	0	7	7	13	8	100	0	7	6	9	5	0	5
Taxa Present	Pinus	0	0	0	1	0	0	0	0	0	0	1	0	0	0	29	0	0	2	3	0	0	0
	Poaceae (Wild)	23	1	0	6	1	0	0	0	0	0	0	3	0	2	14	0	3	0	0	0	0	0
	Poaceae (Domesticated)	13	2	10	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Carya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0
	Fern (Trilete)	7	1	0	2	0	0	0	0	0	0	0	0	0	0	6	0	1	0	0	0	0	0
	Fagus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0
	Liquidambar	0	0	0	0	0	0	0	0	3	0	0	0	0	0	6	0	0	0	0	0	0	0
	Taxus	2	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
	Liriodendron	7	0	0	2	0	0	0	0	1	0	0	0	0	1	4	0	0	0	1	0	0	1
	Fern (Monolete)	1	0	0	0	0	1	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
	Sapinudus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0
	Magnolia	6	1	3	0	0	0	0	0	1	0	0	2	0	0	3	0	0	0	0	0	0	1
	Quercus	0	0	8	1	0	0	0	0	0	0	0	0	1	0	3	0	2	0	0	2	0	0
	Nymphaceae (Brasenia)	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0
	Tilia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Tsuga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Chenopod	0	0	0	4	2	0	0	0	0	0	0	0	2	2	1	0	0	0	1	0	0	0
	Sparganium	0	0	0	0	0	0		0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Abies (balsamea)	12	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Papaveraceae (Sanguinaria)	6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Styracaceae (Halesia)	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Berberidaceae	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Asteraceae	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Plataginaceae	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Crataegus	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Saponaria	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tribulus (terrestris)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cercis (canadensis)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Equisetaceae	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mitchella	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Marchantia	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Nyssa	0	0	1	0	1	0	1	0	2	0	0	1	1	0	0	0	0	0	0	0	0	0
	Viburnum	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cabomba	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Haloragaceae	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Moss	0	0	0	7	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fungus	0	0	16	2	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	1	0	0
	Cornus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
	Calycanthus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Unknown	5	0	14	8	6	0	1	0	6	0	5	0	8	2	4	0	1	1	4	1	0	2



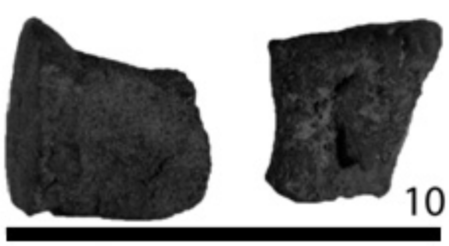


Figure 10. All scale bars equal 1cm with the exception of #7 which has a scale bar of 1mm. 1. Carbonized wood; 2. Oak (Quercus sp.) charcoal; 3. Pine (Pinus sp.) charcoal; 4. Maple (Acer sp.) charcoal; 5. Chestnut (Castanea sp.) charcoal; 6. Insect parts; 7. Raspberry-like seed fragment (cf. Rubus sp.); 8. Walnut (Juglans nigra) shell fragment ; 9. Acorn (Quercus sp.) shell fragment; 10. Hickory (Carya sp.) shell fragment.

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